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ANALYSIS OF SIXTY-NINE CASES OF THAT INJURY.

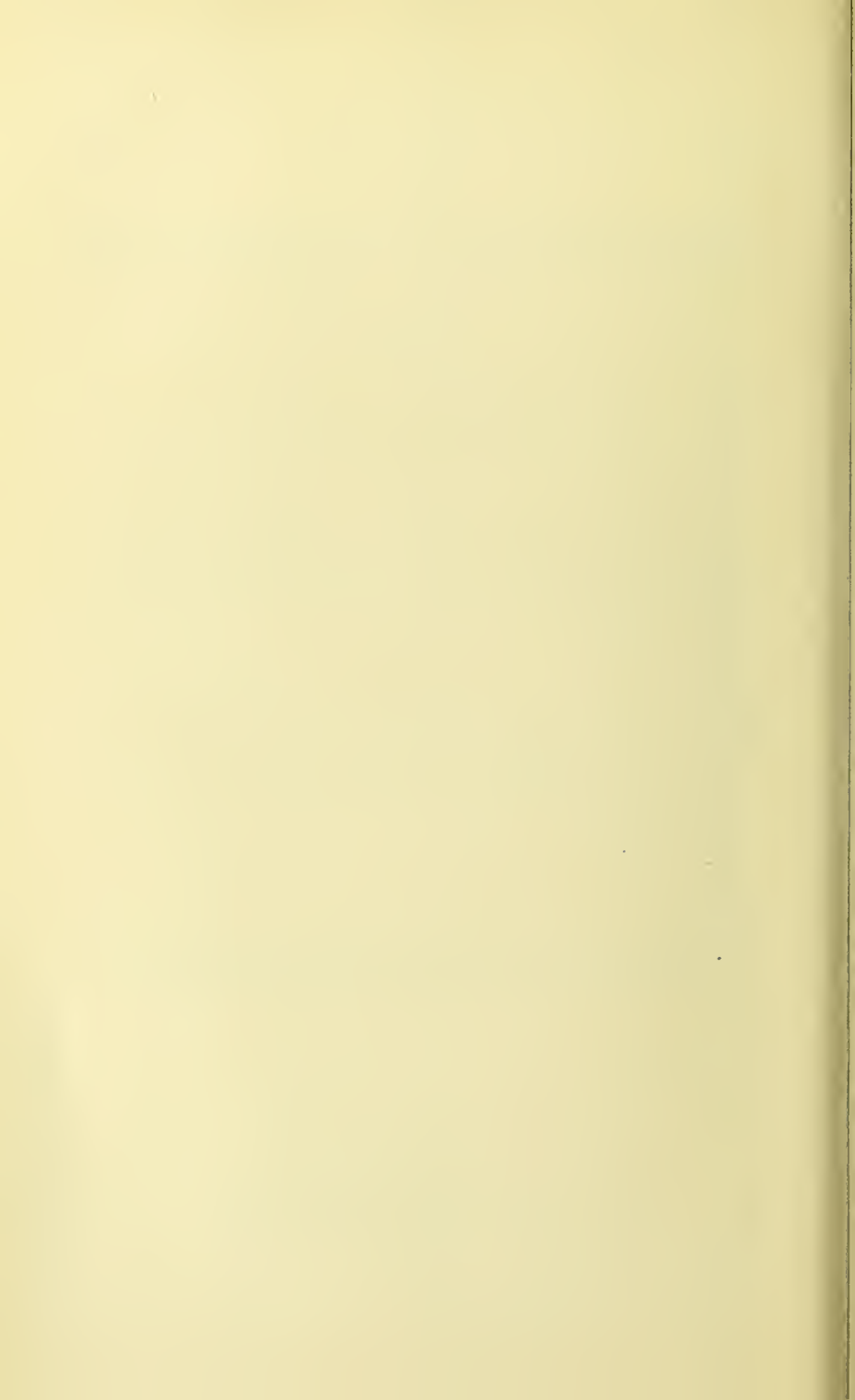
BY  
ALFRED POLAND, F.R.C.S.,  
SURGEON TO GUY'S HOSPITAL.

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COMPOUND fractures of the patella have received but little notice or consideration in surgical works.

Even up to the present period there are but scanty remarks on this lesion, excepting such scattered notes as are attached to cases mentioned in the various periodicals. In fact, these injuries are generally cursorily passed over, and summarily dismissed with the terse phrase "that these are cases in which amputation of the limb is to be resorted to." This latter doctrine we hope to modify, so that it may be applied only to such cases as are attended with extensive crushing of the structures of the joint in association with compound fracture of the patella, and in which resection of the joint is inadvisable.

Our attention was more particularly directed to this class

of injuries in consequence of having had under our care in Guy's Hospital an interesting case of the kind, and which involved the question as to the propriety of primary amputation. Although this case was attended with serious after-consequences, and therefore rather in favour of the doctrine upheld, yet it afforded us a sufficient basis to form a paper on the whole question, and which we have ventured to lay before the Society for their judgment.

It is true that Dr. G. Bouchard,<sup>1</sup> of Paris, has recently published a very excellent brochure on this injury, but he has included together all lesions of the joint-structure, such as fracture of the condyles of the femur and head of the tibia, thus opening a very wide field of inquiry; his collection of cases are arranged according to the different phases of inflammation, suppuration, ulceration, and repair. In the present communication, however, we have confined ourselves entirely to the patella, and arranged the cases in a tabulated form according as the fracture was produced by incised, lacerated, or gunshot wounds; at the same time we have thought fit to append a table of the more serious compound fractures of the joint, in order to show how some of this class of cases may under certain circumstances be recovered from and repaired without the loss of a limb.

The following is a general outline of our case, from notes by Mr. C. S. Chevallier.

George M—, æt. 28, a boiler maker, was admitted into Guy's Hospital on January 19th, 1869. About eight weeks previously he received a transverse lacerated wound over the anterior surface of the right knee, which was produced by a fall on the knee, and for which he was treated as an out-patient at the hospital. The wound was about three and a half inches in extent and the patella was exposed, but the joint was not injured. The edges of the wound were brought together by strapping, and a back splint was placed behind the knee-joint. The case progressed favorably, union of the edges took place, and cicatrization was almost completed, when, about

<sup>1</sup> Bouchard, G., M.D., 'Des Fractures de la Rotule compliquées d'ouverture de l'articulation Tibio-femorale, et de leur Traitement.' Paris, 1868.

three days previous to his present admission, he removed the splint and went about his employment. Early on the morning of the 19th, eight weeks after the first accident, he caught his foot in a grating and was thrown down on his side, in his fall using great muscular exertion to save himself. The newly cicatrized wound was torn open and he suffered great pain. He was immediately brought to the hospital. There was found a large gaping wound at the site of the original injury, as also a transverse fracture of the patella; there was hæmorrhage and escape of synovial fluid from the joint. The dresser on duty introduced his finger into the wound, through the fracture, and into the joint. The wound was closed by sutures, a compress of lint with strapping applied, and a back splint adjusted behind the knee. In this condition he came under the author's notice. The man appeared to be in exceedingly bad health, suffering from a chronic cough and general debility, which gave rise to the suspicion of phthisis, although no evidence could be elicited by the stethoscope.



In the course of three or four days, inflammation and swelling of the joint ensued, with the usual concomitant symptoms. The dressings and sutures were removed and carbolic acid lotion applied to the wound, which was looking unhealthy and had a sanious discharge. On the tenth day suppuration of the joint had fully set in, and the discharge was profuse. This, however, suddenly lessened, when symptoms of pyæmia became manifest, but fortunately suppurative action in and about the joint reappeared, necessitating the use of free incisions into the joint and into such depôts of pus as had formed above and below the joint.

During a lingering and tedious suppuration, with ulcerative action going on in the joint, for a period of six weeks, the man's health began to give way, and on consultation it was agreed that amputation should be performed at the first favorable opportunity, and this was done on the 5th of March. The man made a most rapid recovery and gained flesh, although he did not lose his cough entirely.

The chart of the temperature taken during the progress of

the case presented the usual phenomena of rise and fall during the formation and evacuation of suppurative depôts, and offers nothing of any special interest for recording.

The condition of the knee-joint after removal of the limb presented the following appearances :

There was a  shaped wound in the integuments over the knee, extending down to the bone, the remains of the original wound and that made by the surgeon ; the edges appeared healthy, as if cicatrization was in process of formation. The patella was fractured transversely in its outer two thirds, and then two oblique fractures proceeded from this along the inner third, the one running upwards and inwards, and the other downwards and inwards, giving a triradiate character, , to the whole. The transverse portion had its edges in contact and was covered by thickened tissue, in which nodules of new bone had formed both in the upper and lower fragments, somewhat overlapping and interlocking each other, showing an attempt at bony union. The internal upper radiation had its edges separated, freely laying open the joint ; the lower radiation, appearing more like a split, was completely covered by dense and thickened fibrous tissue, derived from the aponeurotic covering, and the edges were so close as to prevent any opening into the joint.


The interior of the joint presented all the usual appearances of the process preparatory to ankylosis.

The cartilage on the posterior surface of the patella and condyles of the femur was mostly removed ; the inter-articular fibro-cartilage had almost disappeared, and the crucial ligaments were softened and partially absorbed. The osseous surfaces were covered with lymph, and the bone structures rather soft. The integuments, cellular tissue, and muscles above and below the knee, were indurated and infiltrated with a kind of sero-albuminous material.

The preparation is preserved in the museum of Guy's Hospital. No. 1212<sup>10</sup>.

We will now briefly allude to the special points of interest attached to the case.

And *firstly* the extraordinary and unusual nature of the

accident. The man meets with a lacerated wound in a transverse direction over the middle of the patella, the wound extending to the bone itself, severing the fibrous aponeurosis or protective external periosteum of that bone, and thus so far rendering the patella more amenable to lesion should any subsequent injury occur. At an interval of eight weeks the patient does meet with a second injury to the same joint; he trips up, uses great muscular effort to prevent his falling, and comes to the ground. The newly healed cicatrix is torn open and the patella fractured. The man maintained that he felt the tear and snap of the knee-cap before he fell, but in this he must have been deceived. He may, no doubt, have torn open the cicatrix by muscular exertion, but the peculiar nature of the fracture of the bone, as displayed in the after examination of the joint, tends to show that it was produced by a direct fall, for had the fracture been caused by muscular efforts it would have been of the ordinary transverse variety, and not the transverse  shaped fracture which was present.

On searching the records of surgery only one case bearing any strict analogy to the foregoing could be met with.

It is one described by Pelletan, and is referred to in No. 41 of our table. In this instance there was precisely the same double injury; the wound in the first injury was very small, but attended with a good deal of inflammation, and eventually cicatrized. The second accident occurred at an interval of three months; he fell with his knee doubled under him, the newly cicatrized wound was torn open, and the patella broken transversely across, the separation of the edges being such that one of the condyles of the femur was exposed. Whether this fracture was produced by muscular exertion or by direct violence is an open question, but the probability is the latter.

It may not be out of place to refer to two cases which cannot be called compound fractures of the patella and yet have been classed among them, but which have been excluded from the table, considering that they approach rather the characters of lacerated wounds of the joint. The one is the



oft-quoted case of Sir C. Bell,<sup>1</sup> where a simple fracture of the patella became united by ligament, and where subsequently there occurred an extensive laceration of the integuments and this ligamentous union, laying open the joint. Immediate amputation was performed.

The second case is mentioned by Dr. Croker King,<sup>2</sup> where a gentleman met with a fractured patella which united by ligament with a separation of half an inch. About five months after, he fell with his knee bent under him, causing an immense laceration in front of the joint, tearing through the ligamentous union and opening the joint; inflammation and suppuration followed; secondary amputation was urged, but refused; free incisions were made; he progressed favorably, and cicatrization was complete thirty-three days after the accident.

There is a third case,<sup>3</sup> similar to the above, of a very closely united fractured patella being forcibly torn asunder by a lacerated wound and thus opening the joint. This case, however, has been retained in the tables, as it approaches in every respect the character of a compound fracture, the lower fragment lying distinctly under the lower edge of the wound: the interval between the first and second injuries being seven months. See Case 28.

The second point requiring a few passing comments is the treatment adopted in the present case. When first seen by me there was considerable doubt as to the line of treatment that should be carried out. Here was a man in bad health, with a chronic cough and depressed in mind from domestic troubles (not alluded to in the report), suffering from a compound fracture of the patella. Were we justified in attempting to save the limb, or should excision of the joint or amputation have been performed? The subsequent course of the case fully confirms the view taken of a possibility of a repair. The man passed through all the primary dangers of inflammation and suppuration of a large joint, having had occasional relapses and threatening symptoms of pyæmia, and yet repair was going on slowly, by the preparatory

<sup>1</sup> 'System of Operative Surgery,' by Sir C. Bell, vol. ii, p. 204, pl. v.

<sup>2</sup> 'Dublin Medical Press,' Dec. 8, 1847, p. 353.

<sup>3</sup> Scutin's case, see No. 28 in the Table.



process of removal of the articular cartilage by ulceration previous to ankylosis ; but, unfortunately, the man's powers began to fail and were not adequate to undertake the completion. His health rapidly gave way suppuration extended above and below the joint, and he was being drained by an exhausting and copious discharge of pus. Under these circumstances no alternative was left but to excise the joint or perform amputation. We preferred the latter, as we considered that the patient had not power enough to undergo the whole process of repair after excision.

The following tables of cases of compound fracture of the patella are now added, and every one has been referred to its original report for accuracy and confirmation.

We have been compelled to omit from these tables three cases of compound fracture of the patella extending into the joint, and brought to a successful termination, which have been mentioned by Hamilton in his third edition of his work on 'Fractures and Dislocations.' The cases are stated by him to be reported by Mr. Post, of New York, in the 'New York Journal of Medicine,' Series I, vol. ii, p. 367 ; but on referring to this work there is no account whatever, and hence we have been unable to ascertain the precise nature of the lesion, whether simple or complicated, the character of the wound, or whether the cases are already included in the tables.

TABLE I.—*Compound fracture of the*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
1	Sailor.	Good.	Fell from mast on deck, striking knee against edge of a ship's cutlass.	Clean transverse wound across knee, dividing the patella transversely, the joint remaining unopened.
2	M., young.	—	Sabre wound.	Wound at external and anterior part of the patella, dividing it throughout so as to expose articular surfaces of joint. It passed obliquely from without inwards, and from above to below.
3	M., grenadier à cheval.	—	Side arm.	Right patella divided through whole of its thickness and condyles of femur involved. Considerable hæmorrhage.
4	M., æt. 6.	Delicate.	Slipped on climbing into bed, and fell out on chamber utensil, fracturing knee.	Incised wound of the joint 1 to 1½ inches long, dividing cleanly the tendon of the triceps, and a portion of the upper border of the patella; crucial ligaments exposed, and articular surfaces of bones and semilunar cartilages.
5	M., middle-aged, joiner.	—	Hatchet.	Left patella divided into two equal parts in its long axis, and joint entirely exposed.
6	M., æt. 11.	Good constitution.	Blow from axe whilst sitting astride log of wood with knee bent.	Complete splitting of lower extremity of patella into an anterior and posterior portion, and then almost severing articular surface of internal condyle of femur, forming a large open wound.
7	M., æt. 15.	—	Straw-cutting machine.	Clean straight wound about 2½ inches long penetrating into joint, dividing partially the quadriceps tendon, and completely the patella in an oblique direction downwards and outwards, so that the upper and outer third of patella lay wholly everted in the gaping wound.
8	Boy, æt. 8.	Healthy.	Blow of an axe.	Patella cut through transversely into two nearly equal portions, so that joint laid open and could be seen into.

*Patella associated with incised wounds.*

Treatment.	Secondary Effects, &c.	Result.	Reference.
Limb extended and placed at right angles to trunk.	Parts healed kindly; no constitutional symptoms; bony union ensued, and a perfect recovery resulted.	R	Travers; Obs. Surgery, 1852, p. 17.
Brought into close apposition.	Swelling of thigh and leg, fever, intense pain in knee, suppuration; swelling extended up to the body; joint became disorganized and full of pus.	D	Recorded by Boyer, 1802; t. iv, p. 30; Bruneau; Thèse de Paris, 1802; Plaies des Artic.
Compression ineffectual; amputation not performed.	Extravasation of blood into joint and surrounding parts; suppuration; complete disorganization of soft parts, femur denuded, and cartilages destroyed.	D	Larrey; Mém. de Chir. Milit., t. ii, p. 475.
Back splint; edges united by sutures as near to patella and triceps as possible. Collodion over wound. No antiphlogistic treatment.	Splint became disarranged, and part of wound gaped, with escape of synovia; readjusted; swelling and redness for several days, and escape of pus, mixed with synovia; granulation. Splint worn for two months; at end of four months perfect recovery, and motion of joint perfect.	R	Orton; Med. Times and Gazette, April 20, 1867, p. 412.
Interrupted suture.	Eight days after, swelling, and tension of thigh, leg, and foot, threatening gangrene; free incisions, and removal of outer portion of patella to give freer vent. Recovery, with straight ankylosis.	R	Gelée, 1785; Journ. de Méd. Milit., t. iv, p. 503; Boyer, t. iv, p. 427.
Protruding portion of internal condyle removed; edges brought together by four interrupted sutures; back splint; ice uninterruptedly for eight days.	Fever and inflammation; controlled; cicatrization completed on seventeenth day. In three weeks fractured patella seemed to have united. Perfect union and ultimate recovery, with entire use of limb.	R	Johnstone, of Montreal; Med. Gazette, vol. 37, n. s. vol. 2, p. 348, quoted by Solly in his "Experiences."
Edges drawn together; parts fully and softly padded; straight splint with dry dressing.	In four days almost complete union of edges. In two weeks patella felt firm. Walked, with aid of crutch and stick, in five weeks; soon able to do without either.	R	Rodgers, of Galston, Ayrshire, June, 1865, communicated by A. D.
—	Fragments of bone united without any apparent affection of the synovial membrane.	R	Dr. Bond; Philadelphia Journal Med. and Phys. Sciences, vol. ii, p. 273.

TABLE II.—*Compound fracture of the patella*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
9	M.	—	—	Compound fractured patella, transversely through the centre.
10	M.	—	—	Small penetrating wound with fractured patella.
11	M., workman, just arrived in London from country.	—	Fell out of ware-house into street.	Compound fractured patella.
12	M., æt. 39, gentleman.	Good constitution, not irritable.	Thrown from gig and struck knee against wheel.	Fractured patella and joint laid open permitting the introduction of the finger. Patella in fragments. Abundant hæmorrhage and escape of synovia.
13	M., æt. 40, labourer.	Healthy, in-temperate.	Fell with leg under him across some pig-iron.	Laceration over knee; patella fractured and comminuted; synovia escaped.
14	F., æt. 19, servant.	Pulmonary catarrh. Feeble.	Fell from 2nd floor on to a grating, which gave way, falling through on to pavement.	Wound of knee and vertical fracture of the patella into two unequal pieces. Very severe acute pain. Much contusion and extravasation of blood in soft parts.
15	M., æt. 33, courier.	Bilious and exsanguineous temperament.	Thrown from vehicle against a pillar.	Comminuted compound fracture of left knee; double fracture of lower jaw. There was a large wound in the knee of the form of Y.
16	M., Brigadier of Cuirassiers.	—	Kick from horse.	Lacerated wound of right knee to extent of one inch, with fractured patella in three pieces.

*associated with lacerated and contused wounds.*

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	Violent inflammation; intense consecutive fever; suppuration; tension; extension up thigh. No opportunity for secondary amputation. Preparation in Museum of St. Thomas's Hospital, Section A, No. 125.	D	Cooper, William, 1797; Guy's Hospital; Sir A. Cooper on Disloc. and Fract., edited by B. B. Cooper, p. 234.
Fomentations and cataplasms.	Inflammation and suppuration; intense symptoms.	D	Birch; St. Thomas's Hospital; Sir A. Cooper; case 135, op. few days cit.
—	Suppuration excessive; amputation advised and refused. Sent into country; recovered, with ankylosed joint.	R	Hawker; Sir A. Cooper; case 136, op. cit.
One small piece of bone removed. Superficially used. Strap- ing, back splint. Constant application of spirit of wine.	Slight febrile symptoms; passed off; no accident. Left bed at end of a month; recovered entire use of limb; union of patella. Lived until 1869, with good use of knee.	R	Dixon, 1819; Sir A. Cooper; op. cit. case 137.
Back splint; large quantity of leeches freely used. Pad- ing, and starch bandage; over wound and bandage.	Great pain, renewal of leeches, subsidence; no subsequent bad symptom. Perfectly cured and useful limb; left hospital in six weeks; union of patella.	R	B. B. Cooper; Sir A. Cooper's work, op. cit., case 139.
Wound brought together and dry dressing.	Abundant suppuration; wound did not heal; febrile symptoms, no sleep, frequent cough. Succumbed to internal affections.	D	Dupuytren; Leçons Orales, t. i, p. 446, edit. 1839.
Two fragments extracted, edges brought together, and venesection; emetics and low diet.	Was able to walk at end of eight days; osseous union of fracture of patella and jaws in five weeks; consolidation of fracture.	R	M. Leimauge, of Berne; communicated by M. Sentin; Gaz. Méd. de Paris, Sept. 10, 1853, p. 576.
Venesection, cold, back splint.	Doing well for four days, and on fifth violent inflammation, swelling, &c. Suppurating joint. Amputation on twenty-fourth day. Fever, hectic, abscess, threatening death. Rallied, and recovered in sixty-seven days.	R	Fournier; Thèse de Paris, 1823; Bouchard, Mémoires, 1868, p. 18, case 2.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
17	M., æt. 51, physician.	Good constitution, quiet.	Horse struck both knees, causing contusion to right and wound of left.	Transverse fracture of left patella, junction of upper with middle third; the iron shoe had cut open the joint by a transverse wound to the extent of five centimetres. When the knee was straightened, the wound of the integuments and the fracture were not parallel.
18	M., æt. 45.	—	Block of stone forced by explosion against right knee.	A long open wound with vertical fracture of the patella, and exposure of the condyles of the femur.
19	M., æt. 48.	Strong and vigorous.	Direct fall on rocky ground.	Transverse wound on anterior surface of knee to extent of 8 millimetres, and transverse fracture of patella. Quantity of blood and synovia escaped.
20	M., Captain Reg. of Dragoons.	—	Whilst galloping struck right knee against wheel of coach, and thrown down with horse.	An irregular contused wound capable of admitting three fingers into the joint; the patella fractured into fragments; abundant hæmorrhage, and free flow of synovia; tumefaction slight.
21	M., æt. 20, worker in clay pits.	—	Fell 40 feet into a pit on to a cask.	Transverse wound at anterior part of knee 12 centimetres long, largely gaping and corresponding to transverse fracture of the patella; edges separated 2 centimetres; collapse, and laid in pit all night; brought to hospital on following day; no swelling, no hæmorrhage; fractured arm.
22	M., æt. 36, workman.	Strong, sanguineous.	Thrown from a rock by explosion, and fell 5 metres on ground.	Patella comminuted and joint laid open; had also fracture of lower part of leg and dislocated clavicle. Wound 22 centimetres transversely and 10 centimetres vertically, in shape of a cross, with loss of substance at the junction of the two branches of the cross.



Treatment.	Secondary Effects, &c.	Result.	Reference.
Edges of wound brought together by sutures, and collodion applied over; limb placed on a raised inclined plane and fixed; application of ice; low diet.	Went on well until fourth day, when fever, suppuration occurred, and decomposing gas escaped. Acute arthritis; extensive phlegmonous inflammation; free incisions. No chance of amputation.	D	Verneuil; Gaz. des Hop., Sept. 2, 1865.
Immobilisation and irrigation for twenty-five days.	Suppuration and phlegmonous inflammation in popliteal space laid open; cicatrization in five months; solid ankylosis, with knee slightly bent.	R	Bleyuie, père; Rev. Méd. de Limoges, Sept. 15, 1867; Bouchard, p. 36, case 15.
Back splint and limb raised, wound brought together, collodion daily over wound, and ice permanently used for two weeks.	Enormous effusion of blood and serosity in joint; inflammation set in and subsided; no local or general disturbance; fibrous callus united the two fragments, and left hospital in fifty days. Some months after had a fall and ruptured the fibrous callus. Treated by immobilisation and again good union. Walks as well as ever.	R	Verneuil; communicated to M. Bouchard, case 16, p. 53.
Fragments placed in position, and edges of wound brought together by strapping, compress, and bandage. Back splint, and leg raised. Evaporating lotions.	Great constitutional disturbance; venesection, purgatives, cold lotion; wound healed by first intention, except a small point in centre. Able to walk at end of three months.	R	Lawrence, 1834; Letter to Sir A. Cooper; Guy's Hosp. Rep. Ser. I, vol. i, p. 241.
Fingers introduced into wound to ascertain condition of condyles and tibia, but both intact; limb extended; continuous irrigation; no attempts to re-unite wound.	Inflammation, swelling, and suppuration, dépôts formed; long incisious perpendicular to the transverse wound, and laying open joint freely; irrigation continued; granulation; gradual recovery, with partial motion and fistulous opening; latter closed by operation. In hospital for five months.	R	Duplay, Sept. 1867; Bouchard, case 21, p. 67.
Wound cleansed, continuous current of cold water; amputation resorted to. Extraction of all the fragments of the patella one by one, and joint thus completely laid open. Cartilage of femur in two places detached. Six sutures in the wound.	Suppuration on fourth day; granulation on the tenth. Dépôts above and below knee laid open, and drainage tubes inserted. Rapid cicatrization, and completed in three months without ankylosis.	R	Emery, 1861; Bouchard, case 23, p. 73.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
23	M., æt. 23, Zouave soldier.	Robust.	Whilst drunk fell from height of 18 metres on to a rock.	Small contused wound, size of 20 centimes piece; joint distended with fluid. Transverse fracture of the patella, the upper piece entire, the lower divided into several unequal fragments held together by the periosteum.
24	M., æt. 23, Dragoon 11th regiment.	Good constitution.	Kick from horse.	Integuments torn to the extent of 2 inches; right patella fractured obliquely from above to below and within outwards; joint laid open and exposed to view. Synovia escaped.
25	F., æt. 38, domestic in country.	—	Thrown from cart.	Laceration over knee, and comminution of the patella into five unequal pieces, great pain and much swelling.
26	—	—	—	Patella broken into pieces, and the opening so large as to admit fingers into joint readily.
27	—	—	—	Bad compound fracture of patella comminuted.
28	M., æt. 26.	Strong.	Fell on corner of pavement.	Transverse wound at anterior and middle part of left knee, transverse solution of continuity of patella, and much separation. Seven months before he had fractured the same patella by fall on pavement, and treated in hospital for three or four months. Soon after, was frightened by a dog and stretched the knee, followed by inflammation and swelling, and was in hospital again for five weeks. Had only left hospital four weeks.
29	M., æt. 35, stage driver.	—	Kicked by a horse.	Compound comminuted fracture of left patella, attended with profuse hæmorrhage.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Back splint and leg raised. Leeches.	Febrile symptoms, inflammation, swelling, and tension; soon subsided. Went on well till seventh day, when large quantity of blood came away from knee; suppuration; laying open joint; drainage tubes; extraction of detached fragments; recovery, with limited motion, but not complete ankylosis.	R	Baizeau, 1862; Bouchard, case 24, p. 76.
Splint behind knee; white of egg bandage.	Patient moved about so that it had to be re-applied on fourth day; external wound cicatrised. Imprudently walked upon crutches on twentieth day; however, cure resulted in forty days, with ankylosis.	R	Recueil de Mém. de Méd. et de Chir. Mil., vol. xxvi, p. 207, 1829.
Removal of the whole of the fragments of patella.	In four weeks able to walk, and at end of several months able to follow ordinary occupation.	R	Congdon, 1843; Lancet, April, 1843, p. 112.
—	Tedious confinement, and formation of abscesses; separation of fragments of bone. Recovery, with stiff joint.	R	Vincent; St. Barth. Hosp., 1820; Observ. Surg. Practice, p. 72, 1847.
Fragments of bone not removed.	Much suppuration, and danger of losing life and limb. Recovered with ankylosis.	R	Vincent; Cooper's Dict., vol. i, p. 755.
Interrupted sutures, strapping compresses, and bandage. Straight splint and leg raised; venesection, emetics, ice.	Pain and swelling; phlegmonous inflammation; suppuration; incision. Had pleuro-pneumonia, fistulous openings—repeated hæmorrhages from these—exhaustion; at end of four months amputation of thigh.	R	Sentin, 1844; Jour. de Chir. de Malgaigne, t. iv, p. 120, April, 1846; Journ. de Méd. de Bruxelles.
Splint, and kept in bed.	No bad symptom, and doing well. At end of four weeks got up and walked with crutches; inflammation and swelling of joint followed; then suppuration, requiring free incision on either side into joint; protracted discharge. Secondary amputation advised and refused. Ultimately recovered, with a partially ankylosed joint. Able to resume his former employment.	R	Levergood, 1859; Amer. Journ. of Med. Sciences, 1860, vol. xxxix, p. 85.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
30	M., admitted into Pennsylvania Hospital, March 25, 1835.	—	Piece of rock thrown by explosion against knee.	Compound fractured patella.
31	M., æt. 20, soldier, 39th line.	—	Bursting of shell.	Contused wound and lesion of patella.
32	M., æt. 28, soldier, 18th line.	—	Bursting of bomb.	Lacerated wound and fracture of patella.
33	M., æt. 28, major B.	Strong, healthy.	Piece of shell.	Laceration of right knee to extent of 4 inches. Patella fractured in five pieces, joint laid open, and anterior part of condyle of femur grazed. The pieces were remaining attached to the capsular ligament, tendon of rectus, and ligamentum patellæ.
34	M., æt. 35, bricklayer.	—	Fell from scaffold and pitched on left knee.	Patella broken into three or four pieces; joint laid open so as to admit fingers, and was filled with blood.
35	M., æt. 29, engineer.	—	Fell with his horse.	Compound fractured patella, and lacerated wound into the joint. The surgeon passed the finger freely into the joint. Patella broken into several fragments.
36	F., æt. 34, servant.	—	In a fit of insanity threw herself out of lofty window.	Compound fracture of left patella opening into the joint; also large lacerated wound over the frontal bone.
37	James D., æt. 26, porter at hotel.	Healthy looking, lived freely.	Stepped on to a glass skylight, and fell through on to a stone floor, 20 feet, alighting on his feet, and fell forwards on his knees.	Compound fracture of the left patella into three or four pieces, the lines of fracture appearing to run from the centre outwards. Lacerated wound over centre of patella, not very extensive. Had also dislocation of right astragalus forwards and outwards.

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	June 6th, six weeks after injury, very slight union of fracture.	—	Kirkbridge, 1835, Amer. Journ. Med. Sci., Aug., 1835, p. 330.
—	Permanent flexion of leg on thigh; ankylosis; incomplete atrophy of limb.	R	Chenu; Statistics of Crimea; Bouchard, p. 37.
—	Complete ankylosis, with fistulous opening at external part of patella.	R	Ditto, ditto.
Back splint and uniform compression.	Traumatic fever moderate, as also the pain and swelling; suppuration in thigh; free incision. Bark, wine, and support. Two pieces of patella came away: the three others remained fixed. Complete ankylosis.	R	Hennen's Military Surgery, 2nd edit., p. 153.
Amputation urged, but refused. Wound drawn together, and covered with white of egg.	On fourth day pain and inflammation; eighty leeches; wound became unhealthy, disposition to gangrene; hectic, fetid, sanious discharge. Lived five weeks.	D 5 wks.	Smyly, 1859; Dublin Quart. Journ. of Med., vol. xxvii, p. 361.
Wound closed by the many-tailed bandage; back splint, and foot raised.	On third day wound unhealthy, and dark fetid matter. Limb greatly swollen, acute pain, fever. On fifth day wound enlarged by incision 2 inches long; abscesses formed and opened. On eleventh day abscess over parotid opened and amputation performed. Death five days after operation, and sixteen days after the accident.	D 16 days	Ditto, ditto.
In such a state of mental excitement that amputation could not be performed.	On fifth day whole limb œdematous, skin red, putrid matter from wound, highly irritative fever, dilatation of wound, abscesses, long incisions at inner side of thigh, knee, and upper part of leg. Wine and opium. On twenty-fifth day was sufficiently rallied; amputation performed; recovery; had no signs of insanity.	R	Ditto, ditto.
Under chloroform the dislocation was easily reduced. Left limb extended on a back splint; wound covered with a pad of lint.	All remained quiet for ten days, when joint became hot and swollen, and febrile symptoms. The wound began to suppurate and discharge freely, but parts around knee remained tense and swollen; abscesses; free incisions. Ligaments about knee became so softened as to require the nicest support to prevent displacement. Later a bandage stiffened with starch, was applied. Recovery in four months, with ankylosis.	R	Savory, 1869; St. Barth. Hosp.; private communication, unpublished.



No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
38	M., æt. 35, carpenter.	Good constitution.	Falling of a heavy iron chain on knee.	A widely gaping wound about 3 inches long, with transverse fracture of the patella, fully exposing the joint.
39	F., æt. 63.	Some years before had inflammation of joint, deep-seated abscesses, and partial ankylosis resulting.	On going up stairs fell down two steps leg doubling under her, knee striking one of the steps.	Transverse fracture of patella, with wound laying open cavity of joint, extending round the knee on either side as far as the popliteal space. Part of fractured patella protruded through the wound; considerable hæmorrhage.
40	M., æt. 37, warehouseman.	Good, has had syphilitic rheumatism.	Fell 8 feet on to pavement, from warehouse, striking knee and wrist.	Transverse wound over ligamentum patellæ; transverse fracture of patella; wound unquestionably communicating with joint. Fractured lower end of radius.
41	M., æt. 26.	Sanguineous, robust.	Fell whilst walking, and struck right knee.	Large open wound, patella ruptured across, and internal condyle of femur exposed to view. Got up and walked for ten minutes. About three months before fell from horse; had a small wound and much hæmorrhage; kept in bed, and able to get about in fifteen days. This cicatrix had been now torn across.
42	M., æt. 28, boiler maker.	Delicate, chronic cough, suspected phthisis, domestic troubles.	Slipped, and fell backwards, fracturing patella and tearing open partially cicatrised wound over patella, and fell on ground.	Transverse lacerated wound over front of knee-joint; starred fractured patella; finger introduced through wound and fracture into joint, and condyles felt. About two months before had a lacerated wound over front of knee-joint, which was nearly cicatrised when the present accident occurred, and was forcibly torn open.
43	F., æt. 30, married; domestic.	Good health, never had a day's illness.	Fell down stairs on both knees, striking right knee against edge of wooden stair.	Small transverse lacerated wound over lower part of patella; portion of latter broken off. Severe hæmorrhage; fainted joint opened.



Treatment.	Secondary Effects, &c.	Result.	Reference.
Integuments brought together by silver sutures; immobility; irrigation.	No secondary effects; perfect union of skin, converting a compound into a simple fracture; joint free, and fairly movable. Recovered, with useful limb.	R	Holden, 1869; St. Barth. Hosp.; private communication, unpublished.
Parts placed in position, sutures, and strapping. Pillow splint and leg raised.	Union of wound by first intention; not slightest constitutional symptoms; able to walk at end of six weeks; perfect recovery; limb even more useful than before the accident.	R	Aldridge, 1869; Med. Times and Gaz., Oct. 30, 1869, p. 513.
Back splint, pad, bandage.	Went on well until end of second week; suppurating joint; incisions; abscesses in leg and thigh; amputation or excision refused; pyæmia.	D 7 wks.	Poland, 1870; Guy's Hospital, unpublished
Great difficulty in arresting hæmorrhage; pressure.	Inflammation, pain, and engorgement of knee and thigh; gangrene threatening; suppuration; incisions; fever; delirium. Death on twentieth day; no opportunity for amputation.	D 20 days	Pelletan; Clin. Chir., t. ii, p. 155.
Back splint, leeches; edges approximated by sutures.	Severe inflammation, and suppuration of joint; incisions; tonics; support. Ulceration of cartilages; threatening pyæmia. Health giving way; amputation on forty-fifth day. Recovery.	R	Poland; case cited. 1869.
Kept in bed at rest; cold applications. Swelling and extravasation of blood, and sent to hospital on fourth day. Dilatation of wound by vertical incision, and removal of detached portion of patella. Back splint and strapping.	Never had a single bad symptom; no inflammation, no pain; patella movable, and no signs of ankylosis. Had a perfect and useful knee.	R	Hilton and Durham; Guy's Hosp. Sept., 1869, unpublished.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
44	M., æt. 40, warehouseman	Tolerably healthy, stoutish, led very regular life, not had a day's illness for 12 years.	Thrown from horse.	Compound comminuted fracture of left patella. Immediate amputation proposed, but man would not submit. Patella broken in many places, and joint laid open.
45	M., æt. 30, tailor, in army.	—	Leaped over a bastion and fell 40 feet into a ditch whilst drunk.	Compound comminuted fracture of right patella, and joint laid open from condyle to condyle. The fracture was perpendicular, and in several small pieces. Other severe injuries.
46	M., St. Bartholomew's Hospital.	—	—	Compound fracture of patella.
47	M., J. D., private 49th regiment, æt. 29.	—	Struck by shell.	Compound fracture of patella ; partial.
48	M., æt. 20.	—	—	Compound comminuted fracture.

TABLE III.—*Compound fracture of the patella*

49	M., Crimea.	—	Gunshot ball.	"Starred" fracture of the patella without opening the joint. Ball did not lodge.
50	M., Mameluke.	—	Pistol shot.	Traversed knee and fractured the patella.
51	M., Lieut.-Col. at Waterloo, June 18.	—	Musket shot.	Entered outer side of right knee and lodged. A hard body presented itself on opposite side of knee, supposed to be the ball. Surgeon about to cut down on it when fire of enemy forced them to fall back on village of Waterloo. Amputation about to be performed, when orders for removal to Brussels.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Wound enlarged transversely, and the pieces comprising the whole patella were removed, with considerable portion of the attached ligamentous structures. Lint soaked in the patient's blood applied, straight splint, spirit lotion.	Considerable but not extraordinary constitutional irritation followed. Anodynes, vin. ant. p. tart., milk diet. On eighth day suppuration in middle of leg, opened, knee-joint granulating healthily. On thirty-first day abscess at outer side of thigh opened. Recovered perfectly, with straight ankylosis. Seen two years after; able to follow his former business.	R	Halton, 1828; Royal Infirmary, Liverpool, communicated by Long, the present Consulting Surgeon, 1870, unpublished.
Immediate amputation strongly urged, but not acted on. Limb extended and placed in fracture box; lips of wound united by four sutures, and compress dipped in blood placed over wound.	Violent reaction and swollen joint; ice applied; subsidence, and removal of sutures on fourth day, wound partly united; remained open at inner angle for many weeks, and gave exit to pieces of patella. Limb useful, and could be flexed as well as ever.	R	Madden; Med. Times and Gaz., Oct. 10, 1868, p. 416.
—	Recovered, with ankylosis, and had the use of the limb pretty freely.	R	Lawrence; Lancet, 1829-30, vol. ii, p. 320.
—	Invalided some time after, with some stiffness of the knee-joint.	R	Macleod; Notes on the Crimean War, p. 323.
Removal of whole of fragments of patella.	Extensive suppuration and pyæmia, death in four weeks.	D	Textor, fils, 1852; Günther's Operative Surgery; Fuchs, Diss., 1854.
<i>associated with gunshot wounds.</i>			
—	Subsequent inflammation, slight; good recovery; motion of joint was considerably interfered with.	R	Macleod; Notes on Crimean War, p. 324.
Removal of all the fragments.	Some severe symptoms which yielded to treatment. Partial cure.	R	Larrey; Mem. de Chir. Méd., t. iii.
General and local depletion, cold, low diet.	Considerable swelling and inflammation subsided. Exploratory incision over prominence of supposed ball, and found to be fractured portion of patella firmly adherent; suppuration, and small pieces of patella came away. Recovery.	R	Hennen's Military Surgery, 1818, p. 162.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
52	M., æt. 15.	Strong, vigorous.	Ball struck knee.	Entered on inner side of knee without injuring condyle, traversed the middle of the patella, breaking it in pieces, and came out carrying fragments of bone with it at external part. Integuments in front of knee intact. Upper and lower pieces of patella left <i>in situ</i> . Apertures well marked.
53	M., young gentleman.	Good constitution, temperate habits.	Gunshot from fowling-piece. Right knee.	Extensive lacerated wound on outside of knee; appeared as if burnt. Patella almost entirely carried away, with exception of a small piece attached to the ligamentum patellæ. Femur, tibia, and crucial ligaments entire.
54	M., æt. 35, private in 20th regiment serving in India.	—	Gunshot wound of left knee.	Ball entered from behind, traversed joint, and shattered the patella on its exit.
55	M., poacher.	—	Gunshot wound of knee during struggle.	Patella reduced to fragments. No fracture of femur or tibia.
56	M., Prussian soldier, Flensburg.	—	Gunshot wound of knee.	The ball entirely comminuted the patella.
57	...	—	Conical bullet.	Lacerated wound like a grazing shot; struck anterior surface of patella obliquely; piece of bullet lodged in the patella. The ball had split after penetrating the bone, and the larger portion had passed on.
58	M., soldier 36th Ohio.	—	Gunshot.	Ball entered a little below centre of patella whilst in kneeling position, and passed through joint.
59	M., soldier 18th U. S. Infantry.	—	Gunshot.	Ball entered middle of patella, carrying away half, and passing out above external condyle.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Limb bandaged from toes to groin, but relaxed on next day.	Inflammation and swelling; suppuration; dépôts opened; fistulous sinuses; counter-opening. Upper and lower fragments of patella became bathed in pus, detached, and were removed; eight months after walked without help. Enlisted in army and served two years.	R	Cambray, 1815; Journ. de Chir. de Malgaigne, Dec., 1846; Bull. Méd. du Nord.
Semiflexion of limb to slight extent; large doses of opium; poultice was continually applied until granulations began to rise.	No local or general symptoms; granulation sprang up; the remaining portion of patella removed; perfect recovery. Five months after able to ride on horseback; cicatrix firm; considerable motion in joint.	R	Ward, of Huntingdon, 1838; Guy's Hosp. Rep. Ser. I, vol. v, p. 88.
—	Recovery, with ankylosis and atrophy of leg. Died twenty-six months after from abscess of liver. Fractured patella found consolidated by osseous matter and united to femur; capsule of joint obliterated.	R	Williamson; Descrip. of prep. of gunshot wound, Fort Pitt Museum, Plate IX, fig. 1; Prep. No. 2944.
Not stated. Was followed by suppurating joint, and deep-seated abscesses in thigh and leg.	On twentieth day, when seen, large open wound, leg swollen, and seat of phlegmonous inflammation. Amputation refused. Resection performed; intense suppurative inflammation. In two and a half months able to get on crutches; limb shortened, rigid, and straight; ankylosis. No fistulous opening.	R	Verneuil, 1864; Bouchard, case 28, p. 89; La Société de Chirurgie, Paris, April 27, 1864.
Amputation refused.	Recovery, with ankylosed joint.	R	Esmarch; Translated by Statham, p. 97.
Extraction of piece of bullet from patella with difficulty some time after. Had been treated with cold applications.	Chronic inflammation and hydrarthrosis followed. Incomplete luxation of head of tibia backwards. Successfully treated by Strohmeyer's extension machine.	R	Ditto, ditto.
Cold applications.	Excessive inflammation and suppuration. Progressed favorably; every prospect of recovery.	R	Fiuley, 1863; Moses' Surgical Notes American War; American Journ., vol. xlviii, p. 363.
—	Inflammation and suppuration. The remaining portion of patella came away by ulceration. Progressed favorably, and well at seventh month, with ankylosis.	R	Ditto, ditto.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
60	Corporal Moses, æt. 34.	--	Conical bullet passed through knee from side to side.	Causing comminuted fracture of patella without injuring condyles or head of tibia.
61	M.	—	Gunshot.	Shattered patella.
62	Corporal Z., æt. 23, 6th regiment Wisconsin Vol.	—	Gunshot.	Compound comminuted fracture. Ball entered outer part of knee, shattered the patella, and passed out through an opening above the patella.
63	M.	—	Gunshot.	Crushing of patella into many pieces.
64	M.	—	Gunshot.	Ditto. No detail.
65	M., æt. 24, soldier 7th line	—	Gunshot.	Ball traversed left knee, and exit above internal condyle. Fracture of patella.
66	M., æt. 25, soldier 49th line.	—	Gunshot, left knee.	Comminuted fracture of the patella.
67	M., æt. 24, soldier 14th line.	—	Gunshot wound, left knee.	Lesion of patella; bone probably carried away.
68	M., æt. 30, soldier 61st line.	—	Gunshot, right knee.	Ball entered from below upwards, fractured external part of the patella, and passed out above joint at outer part of thigh.
69	M., æt. 37.	—	Gunshot wound, shattered joint.	Comminuted fracture.



Treatment.	Secondary Effects, &c.	Result.	Reference.
Not seen until thirteen days after.	Knee swollen, as also thigh; great constitutional disturbance, debility, and diarrhoea; too weak for amputation. Free incision on outer side of joint, and three pieces of patella removed. Diarrhoea continued. Death thirty-one days after injury.	D	Lidell; Amer. Med. Journal, 1865, vol. xlix, p. 297; Amer. Army Department Circular, No. 6, p. 60.
Removal of fragments of patella.	Inflammation and speedy death.	D	Theden Bemerk u. Erf., vol. i, p. 101; case seen by him.
Crawled half a mile and remained two days without treatment, and transferred to hospital on nineteenth day.	Seven small pieces of loose fragments removed, joint suppurating. At end of five months in good condition, and with every prospect of a serviceable limb.	R	Amer. Med. Times, Jan. 30, 1864, p. 52.
Two pieces of detached splinters of patella removed; leeches, &c.	Much constitutional and local disturbance; incision into deep-seated abscess; excessive discharge; exhaustion; amputation refused. Two more pieces of patella removed. At end of five months repair and complete ankylosis.	R	Demme; Mil. Chir. Late Italian Campaign, p. 269.
—	No detail; complete ankylosis.	R	Ditto.
—	Incomplete ankylosis; deep and adherent cicatrices.	R	Pensioners of the Crimean War; Chenu's Statistics, 1854.
—	Incomplete and bad consolidation, large adherent cicatrices, and loss of substance; atrophy of limb.	R	Ditto, ditto.
—	Loss of patella and adherent cicatrices; permanent straight joint.	R	Ditto, ditto.
Immediate extraction of ball at inner part of thigh.	Incomplete ankylosis, and knee bent so that he was unable to touch the ground except with the toes. Large adherent cicatrix.	R	Ditto, ditto.
Removal of whole fragments of patella.	Pyæmia, and death in seven days.	D	Textor, père, 1847; Gunther; Fuchs, Diss., 1854.

## ANALYSIS OF THE FOREGOING TABLES.

I. OF THE INCISED WOUNDS followed by compound fracture there were 8 cases and all males; 6 recovered, 2 died.

The causes in 6 were from direct blows or lesion produced by cutting instruments, as the axe, hatchet, sabre, side-arm, and straw-cutting machine; and in 2 the accident was due to falls, one on the edge of a ship's cutlass from the mast of a ship; and the other from a fall off the bed on to a broken chamber utensil.

The knee-joint was laid open in all, with but one exception, viz. case No. 1; this is one of the only two instances of the whole series of cases in which this peculiarity occurred—a remarkable point which will be referred to at the end of the communication. This case, therefore, assumed the character of a non-penetrating wound, and gave rise to no serious alarm; bony union ensued and a perfect recovery resulted.

Of the 7 cases in which the knee-joint was laid open, 5 recovered, and these recoveries occurred in patients aged 6, 8, 11, 15, and the middle period of life. In three there was no inflammation or suppuration whatever, notwithstanding the removal of a portion of protruding condyle in one instance, No. 6, and in all three there was perfect union of the fracture with a moveable useful joint. The other two cases of recovery had suppuration supervene, of a trivial character in one instance, but in the other it was such as to require the removal of a portion of the patella to give vent to the accumulated pus in the joint.

The two deaths occurred, the one in a civilian, and the other in a grenadier à cheval; both these cases had suppurating joints and deep-seated abscesses along the thigh, and unfortunately no opportunity was afforded to perform secondary amputation.

II. Of the LACERATED WOUNDS associated with compound fracture of the patella there are 40 cases; 35 males and 5 females; 30 recoveries, 9 deaths, and 1 result not stated.

The causes may be arranged as follows :

*a.* Falls from a height on to the ground, uninterrupted ;

Two from a warehouse into the street, Nos. 11 and 40.

One from a scaffold, No. 34.

One from a lofty window, No. 36.

One from a height of sixteen feet on to the ground, No. 22.

Two fell forty feet, one, No. 45, into a ditch, and the other, No. 21, into a pit on to a cask.

One fell sixty feet on to a rock, No. 23.

*b.* Falls from a height, but interrupted in descent, occurred in 2 cases, both falling through a skylight or grating on to the pavement, Nos. 14 and 37.

*c.* Falls from being thrown out of a vehicle, or from off a horse against some resisting body. Six cases, Nos. 12, 15, 20, 25, 35, and 44.

*d.* Two cases from falling down on edge of stairs and striking the knee, Nos. 39 and 43. In one, whilst going up, and in the other when coming down.

*e.* Direct blows from the kick of a horse in cases, Nos. 16, 17, 24, and 29.

*f.* Direct blows from bodies thrown by explosion against the knee, in Nos. 18, 30, 31, 32, 33, 47.

*g.* Direct falling of heavy weight on to knee, No. 38.

*h.* From simply falling down whilst walking and striking the knee, Nos. 13, 28, and 41.

*i.* From muscular effort as asserted by the patient, case No. 42, the only instance of the kind, and is the one narrated in this communication, and which we have ventured to consider as very improbable.

In several cases the cause is not stated, viz., Nos. 9, 10, 26, 27, 46 and 48.

The 30 RECOVERIES have the following results :—

(*a*) GOOD MOTION OF THE JOINT, WITHOUT ANCHYLOSIS, and a perfectly useful limb. Ten cases, the ages varying between 30 and 48 years.

Of these 2 *were females*, æt. 30 and 38 ; in one, No. 43, there was a fragment broken off, which was removed at once ; in the other, No. 25, the patella was broken into 5 pieces,

all of which were removed at once. In both the cases there was not the slightest inflammation or suppuration, and they were able to walk about at the end of four weeks.

*Eight were males*, ages being 30, 33, 35, 36, 39, 40, 48, and one middle aged. In not one of these cases was there any suppuration. See cases 12, 13, 15, 19, 20, 22, 38, and 45. Sir A. Cooper's case, No. 12, æt. 39, lived to the age of 89, with as useful a limb as the other.

(b) PARTIAL ANCHYLOSIS, and with a moderately useful limb in 5 cases.

*One female*, æt. 63, who had for some years previously been the subject of a diseased knee-joint, which resulted in a partial ankylosis of the knee. There was not the slightest inflammation or suppuration following the present injury, and the patient recovered with a more useful limb than before. See case 39.

*Four males*, æt. 20, 23, 25, and 29; three of these had severe and protracted suppuration of the joint and parts around, requiring the use of free incisions. Cases 21, 23, 29 and 47.

(c) COMPLETE ANCHYLOSIS in 11 cases, the recovery being more or less prolonged after protracted suppuration, &c., ages 20, 23, 26, 28, 28, 40, 45, and four not stated. In 8 the ankylosis was recorded as straight. See cases 11, 24, 26, 27, 31, 32, 33, 37, 44. In 1, No. 18, æt. 45, the knee was slightly bent. In 1, No. 31, æt. 20, the ankylosis was attended with permanent flexion of the leg on the thigh, and atrophy of the limb.

(d) SECONDARY AMPUTATION in 4 cases.

*One female*, æt. 34, performed on the 25th day. See case 36.

*Three males*, one a brigadier, age not stated, and operated upon on the 24th day, case 16; the second, æt. 28, on the 45th day, case 42; and the third, æt. 26, at the end of four months, case 28.

THE 9 DEATHS occurred as follows :

*One female*, æt. 19, who had a suppurating joint, and symptoms of phthisis. See case 14.

*Eight males*, æt. 20, 26, 29, 35, 37, and 51; in 2 the ages not stated. Cases 9, 10, 17, 34, 35, 40, 41 and 48.

With one exception all the above cases died of exhaustion consequent upon the suppurating joints and deep-seated extensive abscesses of the thigh and leg, or from pyæmia, and where no opportunity was afforded for performing any operation.

In the exceptional case, No. 35, æt. 29, secondary amputation was performed on the eleventh day, and death resulted five days afterwards.

ONE CASE RESULT NOT STATED; the only record being that at the end of six weeks if any union had taken place it was very slight. See case 30.

The three additional cases of recovery stated to be recorded by Post, of New York, are not included in the above analysis.

III. OF THE GUNSHOT WOUNDS, associated with compound fracture of the patella, there were 21 cases, all males, eighteen recoveries and 3 deaths.

These statistics must on no account be taken as showing the ratio of mortality, for doubtless there are many unrecorded deaths; and, again, the returns of killed and wounded specify only lesions of the knee-joint, without any reference to the individual parts of the structure of the joint; and are generally classed as penetrating and non-penetrating wounds. We must also recollect that it is the successful cases which find their way into the public journals, and hence the large proportion of recoveries in our present table. However, as far as information permits, we have the following deductions:

#### OF THE 18 RECOVERIES—

(a) *Good motion, and a useful limb without ankylosis*, in two cases, both young persons, and both lost their patellæ. The one, æt. 15, case 52, had fragments of the patella come away at the time of the accident, but the greater portions of the bone were removed secondarily when supuration was fully established, and the pieces lying bathed



in pus; he entered the army afterwards, and served two years. The other case, No. 53, had nearly the whole of the patella shot away at the time of the accident, and he in the course of five months was able to ride on horseback.

In case 49 we meet with an example similar to No. 1, where there was a compound fracture of the patella without opening the joint, but in this present instance the subsequent motion of the joint was considerably interfered with.

(b) *Partial or incomplete ankylosis*, mentioned in 3 cases, Nos. 50, 65, 66, in a Mameluke, and in young soldiers, æt. 24 and 25, and in these latter two the repair was anything but satisfactory, there being large adherent cicatrices, and atrophy of the limb in one.

(c) *Permanent or fixed ankylosis* in 8 cases. Of these the ankylosis was straight in 3, cases Nos. 54, 55, and 67. In one the patella became adherent to the femur, and the leg atrophied; in the second, resection of the knee-joint was performed, although the femur and tibia were uninjured, which gave rise to much comment; the man had a suppurating joint and deep-seated abscesses in the popliteal space; he was exhausted, and amputation earnestly demanded; he refused to lose the leg, resection was therefore performed, and in removing the upper part of the tibia a large deep-seated collection of pus was set free; there was subsequently  $1\frac{1}{2}$  inch shortening. The third case occurred in a soldier, æt. 24, where the whole of the patella was lost.

The limb was ankylosed in a flexed position in one case, No. 68, so that the patient could only just touch the ground with his toes.

The condition of the ankylosis is not mentioned in four cases, Nos. 56, 59, 63, and 64; in one of these, No. 59, the patella was lost, part at the time of the injury, and part by suppurative action in joint.

(d) In four cases the condition of the joint is not accurately defined, Nos. 51, 57, 58, and 62.

No. 51 is very similar to case 59, part of the patella being shot away, and the remaining portion coming away secondarily by ulceration and suppurative action in the joint.



No. 57 had subsequently hydrarthrosis and incomplete luxation of the head of the tibia, requiring the application of an apparatus to fix the joint.

In two cases, Nos. 54 and 55, there ensued atrophy of the leg.

The 3 DEATHS took place in cases 60, 61, and 69; in the latter two the shattered patella was removed by the surgeon, and was followed by inflammation and speedy death in the one instance, and pyæmia on the seventh day in the other. The third case was a corporal, æt. 34, who did not come under treatment until the thirteenth day, when he was suffering from a suppurating joint, debility, and diarrhœa. He was too ill for any operative measures, and died thirty-one days after the injury.

*General Summary of the conditions of the fracture in the foregoing cases.*

1. *Single fracture, or fracture in two pieces*, 24 cases.
  - (a) *Transverse fracture* in 14 cases, Nos. 1, 3, 4, 8, 9, 17, 19, 21, 23, 28, 38, 39, 40, 41.
  - (b) *Oblique fracture* in 3 cases, Nos. 2, 7, 24.
  - (c) *Vertical fracture* in 3 cases, Nos. 5, 14, 18.
  - (f) *Small fragment* knocked off in one case, No. 43, and remained firmly adherent in another, No. 51.
  - (g) *Direction and condition of fracture* not stated in 1 case, No. 47.
  - (l) *Splitting of the patella upwards into an anterior and posterior portion by an axe* in one case, No. 6.
2. *Fracture into three or four pieces*, probably starred in 5 cases, Nos. 34, 37, 42, 16, and 49.
3. *Comminuted fractures* in 25 cases.
 

Fourteen associated with lacerated wounds, see cases Nos. 12, 13, 15, 20, 22, 25, 26, 27, 29, 33, 35, 44, 45, 48.

Eleven associated with gunshot wounds, Nos. 52, 54, 55, 56, 60, 61, 62, 63, 64, 66, 69.

4. *Patella shot away* in two cases,—Nos. 53 and 67.

5. *Patella in part shot away* in two cases.

Case 68, the external part; in case 59 one half carried away primarily, and the other half detached secondarily.

6. *Bullet lodged* in patella in one case, No. 57, here only a piece of it lodged, the other portion splitting the bone and penetrating.

*Condition of the fracture not stated* in 10 cases; cases 10, 11, 30, 31, 32, 36, 46, 50, 58, 65.

*General Summary of the Treatment adopted in the sixty-nine cases of Compound Fracture of the Patella.*

For the most part these cases were treated on the same principle as for ordinary simple fracture of the bone as far as regards the fracture.

In respect to the wound complication very little satisfactory detail is given:

In the incised wounds sutures are mentioned to have been used in 3 cases, but apparently with no beneficial effect; and in the lacerated wounds sutures were used in 7 cases with beneficial effect, and union of edges in 3 cases, but the other 4 without any good resulting.

The ordinary methods of treating wounds of joint were generally employed, such as strapping where permissible, application of ice, leeches, irrigation, &c., and in the suppurating stage by fomentations and free incisions, opium tonics and support, &c.

In two cases, Nos. 22 and 23, drainage tubes were used and with beneficial effect.

In two cases, Nos. 37 and 57, the ligaments about the joint became lax, so as to threaten and cause partial displacement, requiring support and instruments to counteract.

The removal of the fragments of the patella occurred

in 20 cases. Primary removal in 11 cases, of which 3 were fatal. Secondary removal in 9 cases, of which 1 was fatal.

In one case, No. 57, secondary extraction of a piece of bullet from the patella was successful.

Amputation urged and not consented to by the patient in 4 cases; two recovered, Nos. 45 and 56, two died, Nos. 34 and 40.

Amputation decided upon, but no opportunity afforded in two cases, Nos. 17 and 41, who succumbed.

Secondary amputation in 5 cases, 4 recoveries, Nos. 16, 28, 36, 42,—1 death, No. 35.

Secondary excision of knee-joint in 1 case with recovery—case 55.

*Conclusions.*—In reviewing the foregoing cases with their analysis, we may safely state—

1. That compound fractures of the patella are not necessarily mortal injuries, and do not require immediate amputation or resection, except when complicated with other injuries of the joint structure. In this latter case the injury done to the integuments and surrounding tissues are such that amputation is preferable to excision.

2. In all cases we should attempt to save the limb, and adopt the ordinary treatment as for simple fractures of the patella, whether comminuted or otherwise. The wound should be accurately closed by sutures, but employed with judgment, strapping and relays of ice should be constantly used.

3. That when suppuration fully sets in, and which must always be expected in severe laceration and in patients of unsound constitution, we must not hesitate for one moment to make free incision into the joint. Drainage tubes may be used, but they are unnecessary.

4. Amputation or resection is only to be resorted to when the powers of the patient fail to repair the injured joint.

5. The extraction of fragments has been resorted to both primarily and secondarily with success; but as a rule detached and loose portions had better be removed at once, providing this does not necessitate further injury to the

joint : if attached, and firmly adherent, they had better by far be left to take their chance of co-adhesion, or to be thrown off and detached during the suppurative process.

With regard to the repair of compound fracture of the patella little information can be gained from the cases, inasmuch as but slight allusion has been made to it in the records, and therefore not much is added to what is generally known on the subject.

The mode of union has been mentioned in a few of the cases, thus : under-*incised* wounds in cases 1, 6, 7, 8, where the edges of the bone are stated to be perfectly united : but whether ligamentous or bony is not alluded to : under *lacerated wounds*, cases 12, 13, and 15, all comminuted fractures, are reported to have had perfect osseous union of the fragments ; in case 19 the transverse fracture was united by fibrous callus, when some months afterwards he met with a fall and ruptured his fibrous callus, but with complete immobilization, good union again occurred. In case 42, one of starred fracture, and examined after removal of the limb, repair by means of osseous material was in process.

Suffice it to say that it is most probable that in many of the cases, and more especially in the comminuted fractures, bony union took place.

Compound fractures arising, for the most part, from direct violence, whether caused by incised, lacerated, or gunshot wounds may, as we have seen, be attended with every variety in the direction and character of the fracture ; thus, it may be transverse, oblique, vertical, starred, broken into single or many fragments. Now in all these (excepting the transverse variety) being for the most part uncomplicated with muscular contraction, the fracture remains *in situ*, and the external fibrous tissue in front generally escaping entire division maintains the fragments in position, and a good coaptation results,—a condition favorable for bony union ; hence, in the majority of these instances, we may expect and do most probably have bony union. In gunshot wounds the wound in the membrane corresponds to the size of the ball, although the bone may be extensively comminuted, and this fibrous tissue, being

thus left almost entire, tends to preserve the coaptation of the fragments.<sup>1</sup>

Mr. Hutchinson,<sup>2</sup> in his observations on Fracture of the Patella, has alluded to the repair of the fracture under consideration. See Proposition VII.

“It appears, then, that osseous union is to be expected where there is perfect coaptation of the fragments, and where the integrity of the aponeurosis or fibrous investment in front of the bone is maintained.

APPENDIX OF CASES OF COMPOUND FRACTURE OF THE PATELLA associated with LESION OF THE OTHER BONES entering into the composition of the knee-joint. There are 16 cases, and numbered from 70 to 85.

These do not, properly speaking, strictly come under our present consideration, inasmuch as they belong to compound fractures of the bones of the knee-joint, and not to one isolated bone, as the patella. Still we have considered it necessary to introduce such few of the cases as stand upon record in association with the subject of compound fractures of the patella, more especially as they may assist us in some measure respecting the treatment which may be adopted. The cases of this description are rarely met with in civil practice, and, therefore, we must look to our naval and military confrères for evidence in the treatment of such injuries, not only in respect of saving the limb, but also as to the value of resection of shattered bones at joints. Unfortunately but few records have been furnished during recent wars in Germany, Schleswig-Holstein, Italy, India, and America. Resection and attempts to save joints have been undoubtedly frequent among the enormous number of wounded soldiers throughout these great battles, yet we have only a few meager unsatisfactory details of any cases, and we have therefore given a brief summary of what is at present recorded for our instruction.

<sup>1</sup> ‘Med.-Chir. Trans.,’ vol. lii, p. 328, 1869.

<sup>2</sup> See Gulliver’s “Experiments and Observations concerning Fractures of the Patella.” ‘Edin. Med. and Surg. Journal,’ vol. 47, p. 160, 1837.



TABLE IV.—*Contused and lacerated wounds with compound*

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
70	M., æt. 19, soldier 2nd Voltigeurs.	—	Bursting of shell.	Fracture of condyle of femur, and of patella.
71	M., æt. 25, Light Artillery.	Robust.	Fell from first floor on to pavement.	Comminuted fracture of right patella and femur, as also lower jaw; with other external injuries and bruises.
72	M., private, 3rd Light Dragoons.	—	Gunshot carbine.	Whilst knee in bent position, ball entered and comminuted the point of the patella, and lodged between the condyles of the femur, splitting it.
73	M., soldier.	—	Gunshot.	Comminuted patella and fractured head of tibia.
74	M., æt. 35, house painter.	Nervous.	Ball traversed left knee.	Ball fractured the patella, the condyles of the femur, and passed out through popliteal space without wounding vessels or nerves. Patella comminuted.
75	M., æt. 25, soldier Chasseurs.	Rather slender.	Ball traversed knee.	Carried away a small fragment of upper part of patella, luxated bone outwards, and broke a portion of external condyle of femur.
76	M., æt. 15.	—	Gunshot, 4 paces off, 1 bullet and 40 small shot in gun.	The ball entered anterior and lateral part of right knee, fractured the patella and condyles of femur, and passed out at inner side of thigh above condyle, and entered into lower part of left thigh near the popliteal vessels, and then made it exit.
77	M., captain of Algerine vessel.	—	Small bullet wound.	Carried away 3 inches of upper part of tibia, a small portion of inferior part of patella, head of fibula, and a small portion of condyle of femur.
78	M., æt. 38, soldier 3rd Pennsylv. Cavalry.	—	Gunshot.	Right patella comminuted, and a compound fracture of the joint.



*Fractured patella and fractured condyle of femur.*

Treatment.	Secondary Effects, &c.	Result.	Reference.
—	Incomplete ankylosis, with permanent extension. Shortening of limb.	R	Chenu's Statistics ; Bouchard, p. 37.
Free incisions. Desault's splint.	Inflammation, suppuration, dépôts, incisions. Hæmorrhage from wound in thigh ; disorganisation of tissues. Death on twenty-second day.	R	Henot ; Recueil des Méd. de Méd et Chir. Milit., 1825, vol. xviii, p. 164 ; Bouchard, case 11, p. 31.
Amputation of the thigh 4 hours after injury.	—	R	Williamson on Prep. of Gunshot Wound in Fort Pitt, Chatham ; Plate VIII, fig. 4, Prep. 2933.
Free incisions into joint and extraction of fragments of patella with head of tibia, and removal of the semilunar cartilages.	Inflammation and disorganisation of joint ; surface of synovial membrane painted with tincture of iodine, and articular surfaces of condyles scraped off. Lived twelve days.	D	American War Circular, No. 6, p. 60 ; Assist.-Surg. Siebold.
Amputation urged and refused. General and local depletion, cold, straight splint.	Violent inflammation and suppuration ; fever. Secondary amputation on eighth day. Pyæmic symptoms, and death in four weeks.	D	Sanson ; Lancette Française, Nov. 9, 1830 ; Bouchard, case 6, p. 21.
Not seen till fourth day.	Enormous swelling of leg and thigh ; intense inflammation and fever ; free incision ; leeches ; removal of pieces of bone. Recovery in forty-five days, with limited motion of joint.	R	Alquié ; Recueil de Mém. de Méd. et Chir. Milit., 1825, t. xvi, p. 6.
Wound dilated ; cloths and three pieces of bone removed ; seventeen bits extracted from different parts of thigh, and thirteen more removed by incisions.	Knee swollen and tense ; inflammation, convulsions, suppuration, subsidence of symptoms, abscesses, detachment and casting off of ten bony splinters, injections, compression, &c. At end of three months perfect cure without ankylosis.	R	Dessault, Chir. Journal, English Translat., vol. i, p. 306 ; Thiebanlt's case, 1791.
Repeated bleedings ; spirit lotion.	Intense pain, inflammation, and fever ; swelling ; convulsions ; removal of splinters ; abscesses ; exfoliation. Recovery protracted, with ankylosis.	R	Percy, Chir. d'Armée, 1792, p. 263.
Seen on tenth day, when half an inch of femur, end of tibia, and patella were resected.	Parts swollen, and patient prostrated at time of operation ; profuse suppuration ; purulent infection. Death eleven days after operation.	D	Bentley, U. S. Vol. American War Circular, No. 6, p. 59.

No.	Sex, Age, Occupation.	Constitution and habits.	Cause.	Condition of Parts, &c.
79	M., æt. 19, soldier 2nd Michigan Vol.	—	Gunshot musket ball.	Ball shattered left knee and fractured patella on right side, laying open the joint.
80	M., soldier 1st Missouri Militia.	—	Gunshot.	Ball fractured patella and external condyle of femur, and lodged in tibia.
81	M., soldier 49th Georgian	—	Gunshot wound, conoidal musket ball.	Ball fractured the patella and external condyle of femur.
82	M., æt. 27, carpenter.	Healthy.	Gun charged with shot and slugs, but the skin over it remained entire contents entered through entrance wound, and outer side of lig. introduced through entrance wound, and patellæ, and exit above patella.	Patella shivered into innumerable pieces though scorched and blackened. Finger extensive injury of condyles of femur detected. A spiculum of patella extruded 1 inch through exit opening.
83	M., æt. 60, a preacher.	—	Circular saw, producing a kind of partial excision of knee.	Infliction of several injuries, and among which was the left knee. The patella was torn into small pieces and entirely removed, together with $\frac{1}{4}$ inch of condyle of femur, leaving a flat surface. Flap of skin left to extent of $1\frac{1}{2}$ inch. Saw did not pass through joint.
84	M., æt. 19, Sergeant Mahony, 15th Mass. Vol.	—	Gunshot.	Ball entered outer side of left knee passed through and entered the right knee fracturing patella, and then through external tuberosity of the tibia, and lodged in head of fibula.
85	M., æt. 31, private 47th regiment.	—	Grapeshot.	Entered outer side of lig. patellæ, passed up through joint, shattered patella, and making exit at anterior part of thigh, partially fracturing femur at its middle.

Treatment.	Secondary Effects, &c.	Result.	Reference.
Left thigh amputated immediately; right joint excised on sixth day; joint disorganized, and head of tibia grazed.	Shattered patella removed, as also two thirds of condyle, of femur, and articular surface of head of tibia. Death in thirteen days.	D	Bontecon, U. S. Vol.; Amer. War Circular No. 6, p. 59.
Resection on seventh day, when much suppuration, and pus evacuated.	Progressed slowly. At end of nine months walked perfectly well. Case not considered authenticated.	R	Assistant-Surgeon Thorne, U. S. A.; ditto, p. 59.
Incision of knee on sixteenth day; half an inch of femur, half an inch of tibia, and whole of patella, removed.	Intense inflammation and suppuration; great suffering. Rallied. Death eight days after operation; no attempt at reparation.	D	Rush, Surg. 1st Pennsylv. Vol.; ditto, p. 60.
As he was in profound sleep from drink, projecting portion of patella removed, and on the following day excision of the knee-joint performed, and careful removal of <i>débris</i> of patella.	Complete recovery, with one and a half inch shortening.	R	Thompson, Dublin Journal, 1868, vol. xlv, p. 27.
Fragments of broken bone removed, and, where adherent, divided by scissors. Flap closed and brought together by ten sutures. Straight position, and in leg box.	Union of edges of wound by first intention; sutures removed on seventh day; no bad symptoms; improved rapidly; could walk freely, and often without stick.	R	Alexander, 1855; American Med. Jour., vol. xxxii, p. 558, 1866.
Seen on fifteenth day. Ball removed from head of fibula, and several loose fragments of tibia and patella removed.	There was copious suppuration, the wounds healed kindly, and at the end of four months every prospect of serviceable limb; no shortening.	R	American Medical Times, January 30, 1864, p. 52.
	In the course of the treatment a greater part of the patella was removed, as well as fragments of femur. Firm union of femur, and ankylosis of knee resulted. He could bear his weight on limb, and walk without crutches.	R	Macleod; Notes on the Crimean War, p. 311.

The foregoing table thus comprises 16 cases, and all males ; of which there were 10 recoveries and 6 deaths.

Of the CAUSES, one, No. 83, was produced by an incised wound inflicted by the circular saw of a straw-cutting machine.

Two were associated with lacerated wounds, No. 70 from the bursting of a shell, and No. 71 from the effects of a fall out of the first floor on to the pavement.

Thirteen were gunshot wounds, 8 recoveries and 5 deaths.

The adjoining bones implicated were chiefly those of the condyles of the femur, either one or both, but there is no very accurate statement on this head.

The patella itself was comminuted in 11 instances ; a portion only broken off in 2 cases, and in 3 not stated.

#### OF THE 10 RECOVERIES—

a. Good union without ankylosis in 2 cases.

One æt. 60, case 83, where all the fragments were removed by the surgeon and where no inflammation followed.

The other æt. 15, case 76, after primary removal of the fragments and where no suppuration of the joint ensued.

b. *Partial ankylosis* in 2 cases.

No. 75, æt. 25, where primary and secondary removal of the pieces of bone was performed, and recovery was complete in 45 days.

No. 70, æt. 19, with extension and shortening.

c. *Complete ankylosis* in 2 cases.

No. 77, after most extensive injury, and secondary removal of splinters and exfoliation.

No. 85, æt. 31, after secondary removal of fragments of patella and femur.

d. *Resection* in 2 cases.

Primary No. 82. æt. 27, with ankylosis and  $1\frac{1}{2}$  inch shortening.

Secondary on seventh day, No. 80, and at the end of 9 months walked perfectly well. This case is not considered to be authentic, although generally quoted.

*e. Removal of ball* from head of fibula and fragments of patella and tibia in 15 days, case 84; prospect of serviceable limb.

*f. Amputation*—primary 24 hours after injury—case 72.

#### OF THE 6 DEATHS—

One No. 71, æt. 25, died from exhaustive suppuration on the 22nd day.

Four had resection of the joint performed. Of these, one was primary, but only partial, and proved fatal on 12th day, case 73.

Three secondary, one performed on the 6th day and fatal 13 days after, case 79. One performed on the 10th day, and fatal 11 days after, case 78. One performed on the 16th day, and fatal 8 days after, case 81.

One had secondary amputation performed on the 8th day and fatal in 4 weeks, case 74.

Table of General Summary of Results.

		65 Recoveries.							20 Deaths.					
Number of cases.	Classes of Injury of Compound Fracture.	Without ankylosis.	With partial ankylosis.	Complete ankylosis.	Condition not stated as regards joint.	Resection.		Amputation.		No Operation.	Resection.		Amputation.	
						Primary.	Secondary.	Primary.	Secondary.		Primary.	Secondary.	Primary.	Secondary.
8	Incised wounds .....	5	—	1	—	—	—	—	—	2	—	—	—	—
40	Lacerated wounds .....	10	5	11	1	—	—	—	4	8	—	—	—	1
21	Gunshot wounds .....	3	3	7	4	—	1	—	—	1	2	—	—	—
16	Complicated with fracture of other bones of joint.	2	2	2	—	1	1 1 ball from head of fibula, &c.	1	—	1	Removal of shattered patella. 1	3	—	1
85	Total .....	20	10	21	5	1	3	1	4	12	3	3	—	2

The three recoveries recorded by Post, of New York, are not included in the above table.

Suppuration of the joint occurred in 43 cases out of the 65 recoveries, and in all the 20 cases of death. Of the 22 cases without suppurating joint, we must exclude 2 cases of primary operation, and 5 cases where the state of the joint is not mentioned, thus leaving 15 cases only.



*Question open for Inquiry.*

Can there be a compound fracture of the patella without involving the knee-joint?

This question is raised by the case related by Mr. Travers, jun., in his 'Observations in Surgery,' p. 17, published in 1852, No. 1 of our present table, where a sailor fell from the mast of an East Indiaman, striking his knee against a ship's cutlass, producing a clean incised wound through the patella without involving the joint, and again by the case related by Mr. Macleod, No. 49 in our table; at page 324 of his work he says, "I have seen only one case in which the patella, being fractured by a ball, the joint was not at the same time opened. The bone was in that case starred, but the ball did not lodge. These two cases are quite sufficient in answer to the question raised, and in order to confirm these I have instituted several experiments on the dead body in order to ascertain this fact. The great difficulty was to produce a fracture of the patella, either in the straight, semiflexed, or extremely flexed position, and even when the patella was fixed in either of these conditions. I used a sharp-edged chisel and a mallet, and succeeded in one instance only in producing a fracture without injuring the cartilaginous coating of the posterior aspect of the patella: the force required was so great as to break through the patella totally, and expose the interior of the joint. I therefore adopted a less severe measure by partially sawing through the patella transversely across its middle, and then forcibly fracturing it by the chisel and mallet, taking care only to splinter the bone. I performed only a few experiments of this kind, and succeeded in breaking through the bone without opening the joint in several instances, thus showing that the posterior lining of the patella is capable of remaining entire, when the bone is completely broken through.

16 <sup>th</sup>  
Rock  
mbr.

